Comparisons of Eclipse mainstream smoke constituent yields to the yields of very low yielding ultra low "tar" cigarettes (Now Box and Carlton Soft Pack) obtained by machine smoking do not change the fact that an extensive battery of scientific tests indicates that Eclipse cigarettes may present smokers with less risk of certain smoking related diseases than other cigarettes. RJRT scientists have recently demonstrated Eclipse is significantly less mutagenic on a per mg "tar" basis than either Carlton Soft Pack or Now Box over a wide range of machine smoking conditions. On a per cigarette basis, Eclipse was less mutagenic than Carlton Soft Pack under all machine smoking conditions tested and was less mutagenic than Now Box when evaluated using the machine smoking conditions mandated by both the Massachusetts Department of Health and the Canadian federal government. In addition, Eclipse was significantly less cytotoxic on both a per mg "tar" basis and a per cigarette basis under the same range of machine smoking conditions.[7]

Astonishingly, Slade *et al* appear to argue that these very low yielding ultra low "tar" cigarettes are the most appropriate cigarettes for the purpose of assessing the risk reduction potential of Eclipse. This argument is presumably based on the assumption that ultra low "tar" cigarettes present less risk to the smoker than the full flavour low "tar" cigarettes used in RJRT's studies. This is contrary to the published position of the National Cancer Institute, which recently concluded that all existing tobacco burning cigarettes present equivalent risk.[8]

As noted by Slade *et al*,[1] smokers typically take larger and more frequent puffs than those specified by the US Federal Trade Commission puffing regimen and they typically smoke Eclipse differently than their usual brand. Therefore, it is essential that a weight-of-the-evidence approach, including studies in smokers, be used to characterise potential differences between Eclipse and other cigarettes.[3] Urine mutagenicity studies conducted in smokers demonstrate that smokers of ultra low "tar", full flavour low "tar", and full flavour "tar" cigarettes all experience substantial, statistically significant reductions ($p < 0.05$) in mutagen exposure when they switch to Eclipse.[9] Furthermore, additional studies conducted in smokers have demonstrated reductions in bronchial inflammation and inflammation of the lower lung when smokers switched to Eclipse.[10 11] These findings are consistent with reductions in smoker exposure to smoke constituents under actual smoking conditions and support RJRT's conclusion that Eclipse may reduce the risks of certain smoking related diseases relative to other cigarettes currently on the market.

J E Swauger
RJ Reynolds Tobacco Co, Winston-Salem, North Carolina, USA

Correspondence to: James E Swauger, PO Box 1487, Winston-Salem, NC27102-1487, USA; swaugej@rjrt.com

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Author's reply

Swauger argues that based on the weight of the evidence, Eclipse, compared to other cigarettes, may present smokers with less risk of cancer and other smoking related diseases. He bases this conclusion on "weighing" the scientific research RJ Reynolds Tobacco (RJRT) has conducted on Eclipse. Our study drew the opposite conclusion.[1] Our analysis of the Eclipse research suggests that Eclipse is as toxic or more toxic than a number of conventional cigarette brands.

RJRT claims "there is no cigarette like Eclipse" based on a comparison of the smoke chemistry of Eclipse with a typical ultralight, Merit. We tested Eclipse against two other ultralight cigarettes, Now and Carlton, and found the smoke concentrations of four major carcinogens to be similar or lower. RJRT's claim that "there is no cigarette like Eclipse" may be misleading to consumers.

We tried to "weigh" the evidence but found that to be difficult since the control cigarettes kept changing between the studies. The smoke chemistry research used a commercial "ultralight" as a reference, the in vitro research a Kentucky "light" cigarette and the human research the "usual" brand of heavy (40 + cigarettes, per day) smokers. The "usual" brands were not identified. We also examined changes in smoke chemistry between the 1996 version of Eclipse and the 2000 version and found that concentration of four major carcinogens doubled in the 2000 version. The concentration of NNK was 1233% greater than RJRT's early 1988 version of Eclipse called Premier.

In 2001, the Institute of Medicine's report "Clear the Air" determined that there was insufficient evidence to conclude that any currently marketed product, including Eclipse, actually met the promise to reduce exposure to toxins or reduce harm.

Since the introduction of Eclipse, a number of other products have been brought into the market place that make explicit or implied claims of being "safer" than conventional cigarettes. These include Omni, Advance, Accord, and a soon to be released Philip Morris product called SCOR. Our article highlights the need for regulation of these products and associated claims by independent agencies such as the US Food and Drug Administration (FDA). RJRT could help "Clear the Air" by supporting pending FDA legislation. Food and drug manufacturers are not allowed to introduce new products into the market and make claims based solely on their own internal research, and nor should tobacco manufacturers. If RJRT truly believes that Eclipse may reduce risks of lung cancer and other diseases, the company should request the FDA to evaluate its scientific research and claims before marketing it at the retail level nationally.

G N Connolly
Massachusetts Department of Public Health, 250 Washington Street, Boston, MA 02108-4619, USA; greg.connolly@state.am.us

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Seasonality in cigarette sales: patterns and implications for tobacco control

Cigarette smoking is the leading public health problem in the USA, contributing to over 400 000 deaths a year.[1] Given its importance, the tobacco control community should be aware of all significant patterns in the consumption of cigarettes that may be relevant to efforts aimed at tobacco control. Unfortunately, little attention has been paid to the seasonal nature of smoking. Findings on seasonal patterns may have major implications for the timing of interventions designed to manage the tobacco problem, both in the USA and in other countries.

In this letter, monthly data for cigarette sales at the state level for the USA are analysed to test for the presence of seasonality and to characterise the phenomenon. The results reveal a seasonal pattern that is significant both in the statistical sense and in magnitude. This includes a significant drop in the winter months of January and February, and an increase during the summer months of June, July, and August.* Because seasonality in sales does not reflect seasonality in production,† it must be inferred that the seasonality is driven by wholesale and retail phenomena, including consumption.

The data used in this study are monthly figures for sales of cigarettes by wholesalers to retailers aggregated at the state level between January 1983 and July 2000. Until December 1997, the Tobacco Institute was responsible for their collection.[2] For the period following this, the firm Orzechowski and Walker produced the data.[3]

Table 1 Summary statistics on seasonality of cigarette sales

State	Spectral analysis (p value for Bartlett's test)	Stable seasonality test (p value)	Seasonal factor range	Months with extreme seasonal effects (month name and number of times the month is a high-2 or low-2 seasonal factor)			
				Most frequent high month	2nd most frequent high month	Most frequent low month	2nd most frequent low month
Alabama	0.0133	<0.0001	23.97	Oct(13)	Jun(10)	Feb(17)	Jan(5)
Alaska	<0.0001	<0.0001	56.45	Jul(11)	Aug(9)	Feb(13)	Nov(9)
Arizona	0.0016	<0.0001	22.69	Jan(10)	Oct(7)	Feb/Mar(17)	*
Arkansas	0.0175	<0.0001	27.73	Jun(17)	May(7)	Feb(17)	Jan(8)
California	<0.0001	<0.0001	21.67	Jun(14)	May(7)	Jan/Feb(17)	*
Colorado	<0.0001	<0.0001	28.50	Sep(12)	Jul/Aug(8)	Feb(17)	Mar(13)
Connecticut	<0.0001	<0.0001	24.17	Jun(11)	Aug(7	Feb(17)	Jan(14)
Delaware	<0.0001	<0.0001	61.65	Jun(11)	Aug(8)	Feb(16)	Jul(9)
DC	<0.0001	<0.0001	50.25	Jun(10)	Oct(9)	Jan/Feb(10)	Nov(7)
Florida	<0.0001	<0.0001	13.90	Apr(11)	Mar/May/Nov(6)	Feb(17)	Sep(11)
Georgia	<0.0001	<0.0001	178.69†	Jun(17)	Jan/Oct/Dec(5)	Jul(17)	Aug(12)
Hawaii	<0.0001	0.0111	36.99	Oct(12)	Jun(8)	Jul(13)	Feb/Nov(6)
Idaho	0.0002	<0.0001	36.28	Jun(14)	Aug(12)	Feb(17)	Jan(10)
Illinois	<0.0001	<0.0001	26.16	Jun/Aug(15)	May/Nov(2)	Jan/Feb(17)	*
Indiana	<0.0001	<0.0001	27.35	Jun(17)	Aug(8)	Feb(17)	Jan(14)
Iowa	<0.0001	<0.0001	32.61	Jun(17)	Aug/Dec(5)	Feb(17)	Jan(15)
Kansas	<0.0001	<0.0001	24.35	Jul(14)	Aug(9)	Feb(17)	Jan(7)
Kentucky	0.2371	<0.0001	41.76	Jun(17)	May/Dec(7)	Feb(17)	Jan(10)
Louisiana	<0.0001	<0.0001	30.75	Jun(17)	May(7)	Feb(17)	Jan(7)
Maine	<0.0001	<0.0001	30.63	Aug(17)	Jun(9)	Feb(15)	Jan(12)
Maryland	<0.0001	<0.0001	28.16	Aug(8)	Jun(7)	Jan/Feb(17)	*
Massachusetts	<0.0001	<0.0001	30.49	Jun(17)	Aug(8)	Feb(17)	Jan(14)
Michigan	<0.0001	<0.0001	19.85	Aug(12)	Jul(8)	Mar(17)	Feb(13)
Minnesota	<0.0001	<0.0001	35.46	Jun(13)	May(6)	Feb(16)	Jan(8)
Mississippi	0.0913	<0.0001	23.02	Jun(17)	May(7)	Feb(17)	Jan(8)
Missouri	<0.0001	<0.0001	20.18	Jul(15)	Aug(12)	Feb(17)	Mar(14)
Montana	0.0067	<0.0001	38.40	Aug(17)	Jun(9)	Feb(17)	Apr(6)
Nebraska	<0.0001	<0.0001	29.32	Jun(14)	Aug(9)	Feb(17)	Jan(14)
Nevada	<0.0001	<0.0001	20.12	Jun(11)	Jul(8)	Feb(16)	Mar(8)
New Hampshire	<0.0001	<0.0001	38.16	Jun/Aug(17)	*	Feb(17)	Jan(15)
New Jersey	<0.0001	<0.0001	27.43	Jun(16)	Dec(10)	Jan/Feb(17)	*
New Mexico	<0.0001	<0.0001	29.30	Jun(17)	Sep(11)	Feb(12)	Jan(10)
New York	<0.0001	<0.0001	27.17	Apr(9)	Jun(8)	Feb(17)	Jan(9)
North Carolina	<0.0001	<0.0001	35.29	Jun(13)	Jul(9)	Feb/Mar(17)	*
North Dakota	<0.0001	<0.0001	29.53	Jun/Aug(9)	Sep/Oct(5)	Feb(12)	Jan(9)
Ohio	<0.0001	<0.0001	23.43	Jun(12)	Jul(10)	Jan/Feb(17)	*
Oklahoma	<0.0001	<0.0001	27.59	Jun(17)	May(11)	Jan/Feb(17)	*
Oregon	<0.0001	<0.0001	28.45	Jun/Aug(10)	May(7)	Feb(17)	Jan(14)
Pennsylvania	<0.0001	<0.0001	25.68	Jun(17)	Dec(6)	Jan/Feb(17)	*
Rhode Island	<0.0001	<0.0001	30.87	Jun(15)	Aug(9)	Feb(17)	Jan(14)
South Carolina	0.1222	<0.0001	29.95	Jun(17)	Dec(7)	Jan(17)	Feb(14)
South Dakota	0.0128	<0.0001	34.99	Jun(11)	Jul(10)	Feb(17)	Nov(9)
Tennessee	0.0001	<0.0001	29.62	May(16)	Jun(10)	Feb(17)	Jan(10)
Texas	<0.0001	<0.0001	27.65	Jun(13)	Dec(11)	Feb(17)	Jan(13)
Utah	0.1037	<0.0001	34.04	Aug(14)	Jun(12)	Feb(17)	Jul(5)
Vermont	<0.0001	<0.0001	29.11	Aug(14)	Sep(12)	Mar(12)	Feb(11)
Virginia	<0.0001	<0.0001	33.38	Jun(17)	Aug(9)	Feb(17)	Jan(8)
Washington	<0.0001	<0.0001	26.53	Jun(12)	Aug(11)	Feb(17)	Jan(10)
West Virginia	0.2684	<0.0001	21.95	Aug(16)	Jun(12)	Feb(16)	Oct(6)
Wisconsin	<0.0001	<0.0001	24.27	Aug(14)	Jul(10)	Feb(17)	Mar(8)
Wyoming	0.0237	<0.0001	38.51	Aug(12)	Jun(10)	Feb(14)	May(7)

*All 34 (17×2) possible occurrences of "high-2" or "low-2" months are represented by the two tied "most frequent" months.
†Georgia has an abnormally large June (fiscal year) effect.

Two methods were used to examine seasonality. The first was spectral analysis, which identifies cyclical patterns in the data. If a cycle of a particular length is revealed to be important, then a systematic phenomenon may be inferred to underlie the pattern.[4] In the case of seasonality, a cycle of period 12 months would stand out, and the spectrogram of the data would be statistically different from that produced by a white noise or uniform random process (Bartlett's test). The state level data contain a prominent 12 month cycle, indicating seasonality. In addition, for 46 out of the 51 locations studied, the spectrogram was significantly (5% level) different from that produced by a uniform random process (table 1, column 2).

Second, the time series were seasonally decomposed. This involved splitting the series into trend, seasonal, and irregular components.[4] Using the seasonality analysis, a number of indicators were generated. The p values in table 1, column 3 correspond to the null hypotheses of no stable seasonality in sales. At a significance level of 5%, the null hypothesis of no seasonality is rejected for all the states.

In percentage terms, the seasonal effect is large—as column 4 shows, the mean annual range (difference between high and low factors) across the 17 years is about 30%. To put this in perspective, assuming a price elasticity of –0.4,[5] a 30% drop in sales would require a 75% increase in cigarette prices!

Next, to identify the months for which sales were uniformly high or low for any state, for any one year cycle in the data, the two months with the highest and the two with the lowest seasonal components were selected, and the frequency of the appearance of the months in the "high-2" and "low-2" months was computed by state. Columns 5–8 show the most frequently appearing high and low months. February appears as a "low-2" month for all but one state, and June appears as a "high-2" month for 42 states. Figure 1 shows that January and February are a "low" season for

*This pattern is seemingly contrary to the popular belief that smokers tend to smoke more in winter (perhaps to keep warm) and less in summer.

†This was confirmed by parallel analyses of production data and discussions with an expert on the production of tobacco.

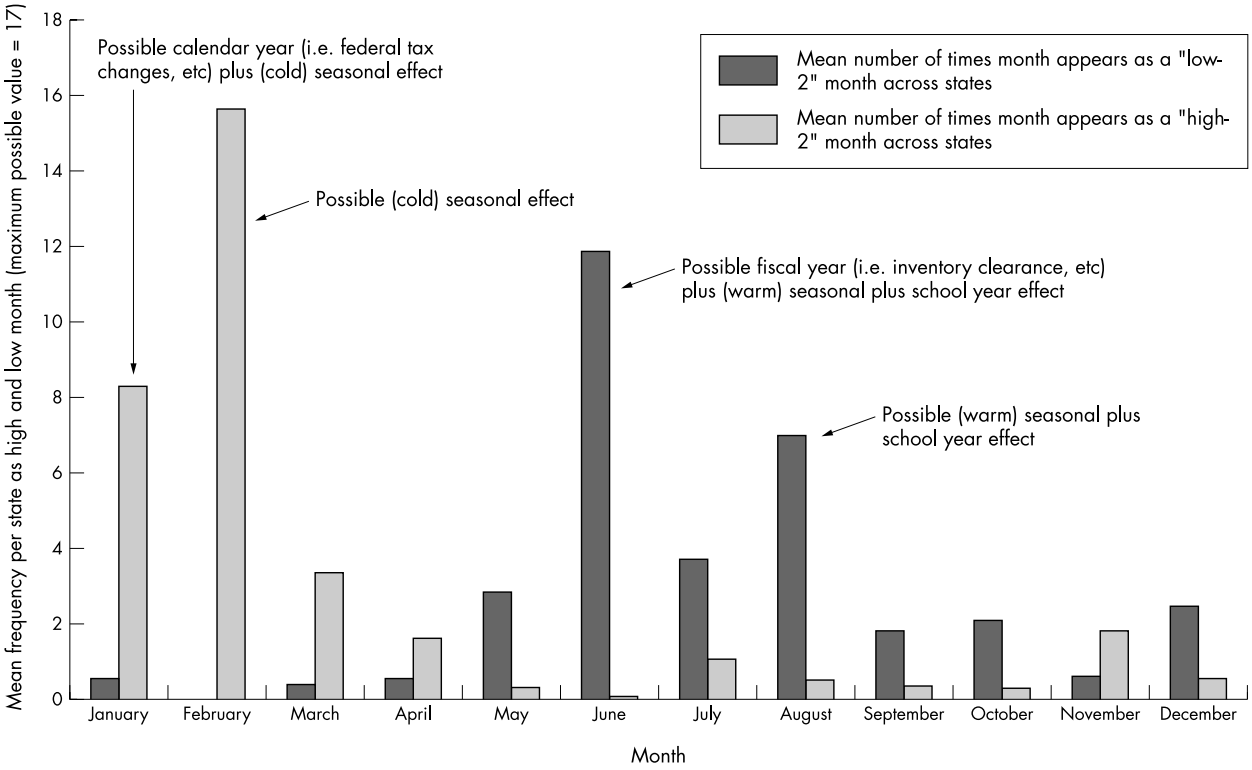

Figure 1 Months with high and low seasonal factors (with possible reasons for prominent months).

sales, and June, July, and August, a "high" season.

Possible causes of seasonality include the effect of climate on smoking behaviour (low in cold weather and high in mild weather, especially in view of now widespread indoor smoking restrictions across the USA), the timing of tax changes (December-January or June-July), the timing of the new fiscal year (June-July), the timing of school year (August-June), and the timing of quitting efforts tied to New Year's resolutions (December-January). In the obvious extension to this research, the determinants of this potentially important statistical phenomenon will be analysed in detail.

The present findings demonstrate that sales of cigarettes in the USA have a strong seasonal component. This has potential implications for the timing of cessation initiatives and other time dependent policies. The phenomenon of seasonality could hold the key to significant advances in tobacco control and in the management of a leading public health problem.

S Chandra
Graduate School of Public and International Affairs, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

F J Chaloupka
Department of Economics, University of Illinois at Chicago, Chicago, Illinois, USA

Correspondence to: Siddharth Chandra, GSPIA, 3R25 Wesley W Posvar Hall, University of Pittsburgh, Pittsburgh, PA 15260, USA; schandra@pitt.edu

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Way-out developments at BATCO

Working in tobacco control, it is easy to get the impression that the tobacco industry is a united front, with all parties carefully avoiding internal divisions that might undermine the greater struggle against the "antis". However, tobacco industry documents that have been made public as a result of litigation in the USA frequently reveal ruthless competition for market share, as well as intense suspicion about competitors' activities. This was brought home to us recently when reading a 1977 document on "developments in the scientific field" by Dr Sydney J Green, then British American Tobacco's (BAT's) senior scientist for research and development.[1] After several pages of unremarkable reports on industry and external research on low tar cigarettes and smoking and health, Green informed his readers about two "way-out" developments at BAT:

- Way-out development 1: "A way-out development is that of compounds (such as etorphine) which are 10,000 times as effective as analgesics [such] as morphine and which are very addictive. It is theoretically possible (if politically unthinkable) to add analytically undetectable quantities of such materials to cigarettes to create brand allegiance. But this thought may suggest the possibility of such compounds occurring naturally."

We are grateful to Dr Green for clarifying what "brand allegiance" really means for the tobacco industry.

- Way-out development 2: "Another way-out development, which arises from work done in a quite different area, is that it would now be quite feasible and quite inexpensive to produce an unacceptable off-taste in cigarettes from some factories for a prolonged period without approaching nearer than half to one mile."

In the same spirit of scientific curiosity which no doubt motivated the BATCO researchers, we would be very interested to know the formula for this substance.

On a more serious note, while we were not able to come up with any plausible candidates for a substance that could make way-out development 2 feasible, we are concerned that Green was right about the feasibility of adding etorphine or some other addictive substance to cigarettes.

Green's report followed an earlier memo from Kieth D Kilburn to CI Ayres,[2] expressing